

REMARKS

The Office Action was issued on pending claims 1-5 and 7-12. Claims 2-4 and 9 have been withdrawn from consideration. Claims 1, 5, 7, 8 and 10-12 stand rejected. In this Response, claims 1 and 5 have been amended and no claims have been added or cancelled. Thus, claims 1-5 and 7-12 are pending in the application, and claims 1, 5, 7, 8 and 10-12 are under consideration.

Applicants invite the Examiner to call Applicants' Representative to discuss any issues with this application.

Drawings and Specification

On pages 2-4 of the Office Action, the drawings and Specification were objected to for informalities.

As to the drawing objections, the Office Action states that the previous proposed drawing corrections were disapproved. Accordingly, the amendments to the drawings in this Response are based on the drawings originally filed with the application. Originally filed Figs. 1-5, 8-10 and 20 have been canceled without prejudice. Originally filed Figs. 6, 7 and 11-19 have been amended to renumber the figures in view of the canceled figures. Figs. 6, 7 and 11-19 have been renumbered as Figs. 1-11, respectively.

As to the specification objections a substitute specification was required before the application passes to issue. A substitute specification will be prepared to correct the informalities upon approval of the drawing corrections. The substitute specification will be submitted prior to issuance of the application.

Claim Rejections – 35 USC § 112

At page 4 of the Office Action, claims 1, 5, 7-8 and 10-12 were rejected under 35 USC § 112, first paragraph, as failing to comply with the written description requirement. Applicants respectfully disagree.

However, Applicants amend claim 1 to quickly place the application in condition for allowance. The text “for not disturbing the plasma flow” has been deleted from claim 1 and

claim 1 has been amended to clearly describe how the electrode is disposed. The recited feature of "said electrode in an orifice shape is concentrically disposed beneath the plasma vent" is supported by the application as originally filed. See the specification at page 27, lines 21-24 which states "at a center of the three layers of the electrode 5', the insulating material 10 and the conductive plate 39, a plasma vent 16 having an orifice shape with a circular section is formed." See also, renumbered Fig. 3 (original Fig. 11).

The recited feature in claim 1 "electrodes disposed in pair so as to be opposed to each other interposing a plasma flow spurted out from the plasma vent" is also supported by the application as originally filed. See specification at page 23, lines 15-19 which states "a pair of opposed electrodes 19a, 19b are disposed so as to interpose a substrate S, which is mounted on a substrate supporting table 8 in a substrate processing chamber 4, namely, interpose the plasma flow, which flows out from a plasma vent 6." See also, renumbered Figs. 1 and 2 (original Figs. 6 and 7).

Thus, Applicants respectfully submit that the § 112 rejections should be withdrawn.

Claim Rejections – 35 USC § 103

At pages 5-11 of the Office Action, rejections under 35 USC § 103(a) were entered. Claims 1, 5, 7 and 10-12 were rejected under 35 USC § 103(a) as being unpatentable over Canon (JP 63-255373) in view of Hitomi et al. (JP 3-158469) and Takahiro et al. (JP 63-286570). Claim 8 was rejected under 35 USC § 103(a) as being unpatentable over Canon in view of Hitomi et al. and Takahiro et al., and further in view of Collison et al. (US 6,203,657). Claims 1, 5, 7 and 10-12 were rejected under 35 USC § 103(a) as being unpatentable over Zarowin et al. (US 5,290,382) in view of Hitomi et al. and Takahiro et al. Claim 8 was rejected under 35 USC § 103(a) as being unpatentable over Zarowin et al. in view of Hitomi et al. and Takahiro et al., and further in view of Collison et al. Applicants respectfully disagree.

Applicants' invention, as claimed in claim 1, pertains to a surface treatment apparatus for generating plasma by a plasma generating electrode in a casing having said plasma generating electrode, a raw-gas inlet and a substrate supporting table, plasma ionizing the raw gas and plasma processing a surface of said substrate, which is mounted on said substrate supporting table. Claim 1 has been amended to clarify the claim. Claim 1 now calls for "electrodes

disposed in pair so as to be opposed to each other interposing plasma flow spurted out from the plasma vent or said electrode in an orifice shape concentrically disposed beneath the plasma vent are/is provided in and between the vicinity of said plasma vent and the vicinity of said substrate supporting table.”

Applicants’ invention, as claimed in claim 1, is distinguished from Cannon, Hitomi et al. and Takahiro et al. As to Cannon, Cannon does not disclose or suggest the structure of Applicants’ claimed surface treatment apparatus, particularly the “electrodes disposed in pair so as to be opposed to each other interposing plasma flow spurted out from the plasma vent or said electrode in an orifice shape concentrically disposed beneath the plasma vent are/is provided in and between the vicinity of said plasma vent and the vicinity of said substrate supporting table.” The Office Action at page 6 even acknowledges that Cannon does not expressly disclose electrodes which disposed so as to interpose a plasma flow spurted out from a plasma vent therebetween, and provided in and between the vicinity of the plasma vent and the vicinity of the substrate supporting table.

As to Hitomi et al., and Takahiro et al., neither of those references have a plasma vent. Thus, there is no teaching, suggestion, or motivation to modify Cannon to achieve Applicants’ invention having the electrode and the plasma vent structure. Furthermore, film formation according to Hitomi et al. and Takahiro et al. would be slower than film formation according to the present invention because of the absence of a plasma vent.

Even further, in Hitomi et al. and Takahiro et al. an electrode is disposed so as to disturb the plasma flow to the substrate, which decreases film formation speed further. On the other hand, in the present invention, the electrodes are disposed in pair so as to be opposed to a each other interposing the plasma flow spurted out from the plasma vent, or the electrode in an orifice shape is concentrically disposed beneath the plasma vent, and an electrode does not get in the way of and disturb the plasma flow to a substrate. Due to the plasma vent and disposition of the electrode, the present invention enables to remarkably increase the film formation speed compared with Hitomi et al., and Takahiro et al.

Furthermore, the electrodes, which excludes charge particles, of the present invention is significantly different from the electrodes of Hitomi et al. and Takahiro et al.

As to Hitomi et al., Hitomi et al. uses neutral active species for film formation generated by electrically neutralizing the charged particles by colliding the particles against the electrode.

On the other hand, in the present invention, the electrodes are disposed outside of the plasma flow as mentioned above. When voltage is applied to the electrode, an electric potential difference is created and it captures the charged particles. For example, when minus voltage is applied, the plus charged particles are captured and vice versa. At the same time, the charged particles having the same electric potential as that of the applied voltage that are not captured by the electric potential difference are forced to change their directions and are excluded from the plasma flow by repulsive force.

As to Takahiro et al., the charged particles are captured by the electric potential difference. However, the electrode of the Takahiro et al. is a mesh-shaped sheet and disposed in the middle of the plasma flow. These features of Takahiro et al. are not capable of excluding the charged particles by repulsive force. Again, the electrodes of the present invention can exclude charged particles by repulsive force and are significantly different from Takahiro et al.

Even further, Applicants respectfully submit that the combinations of the Hitomi et al. and Takahiro et al. with Canon, Zarowin et al. and Collison et al. do not result in Applicants' claimed invention, even if such combinations are proper. The Office Action asserts that Hitomi et al. and Takahiro et al. are properly combinable with Canon, Collison et al. and Zarowin et al. (having two divided chambers and a plasma vent) such that Canon, Collison et al. and Zarowin et al. are modified to result in the present invention. However, in the case of applying the electrode of Hitomi et al. and Takahiro et al. to Canon, Collison et al. and Zarowin et al., the electrode is disposed under the plasma vent and disturbs the plasma flow, which results in slow film formation.

Moreover, the combinations of Hitomi et al. and Takahiro et al. with Canon, Collison et al. and Zarowin et al. do not provide the same features as that of the present invention because the features of Hitomi et al. and Takahiro et al. for excluding the charged particles are different from that of the present invention, as previously mentioned above.

Thus, Applicants respectfully submit that the § 103(a) rejections should be withdrawn.

CONCLUSION

For the foregoing reasons, Applicants submit that the patent application is in condition for allowance and request a Notice of Allowance be issued.

The Commissioner is authorized to charge and credit Deposit Account No. 02-1818 for any fees associated with the submission of this Response to Office Action.

Respectfully submitted,

BELL, BOYD & LLOYD LLC

BY 

Michael S. Leonard
Reg. No. 37,557
P.O. Box 1135
Chicago, Illinois 60690-1135
Phone: (312) 807-4270

Dated: July 28, 2004